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Col. Rainis

Augusta and
the Nitro Bureau

ORDNANCE

Colonel George Washington Rains worked wonders with the Confederacy's nascent Nitre Bureau.

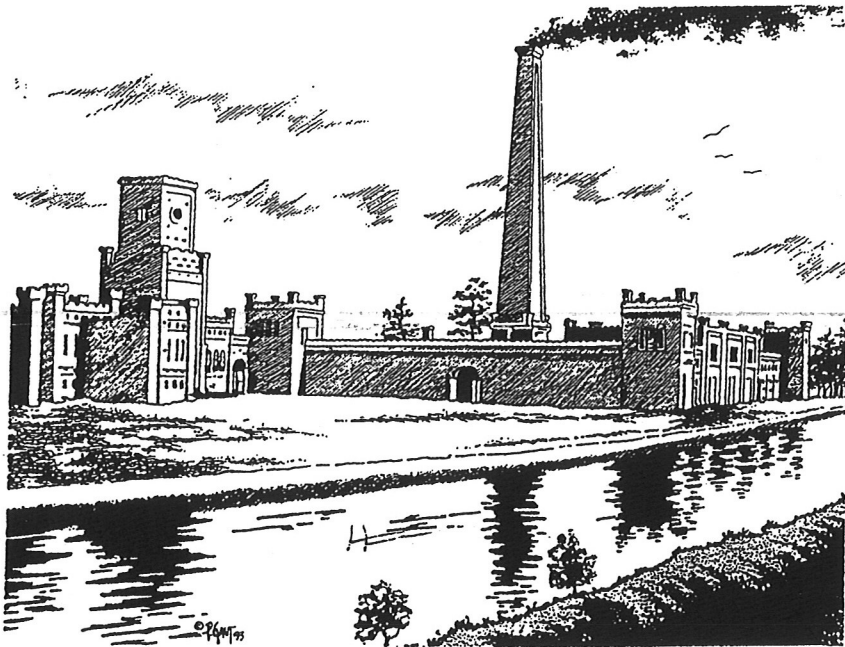
By Louis S. Schafer

On April 27, 1862, the largest gunpowder mill within the entire Confederacy was opened in Augusta, Georgia. It was placed, along with all similar manufacturing concerns, under the direction of the newly created Nitre Bureau, and Colonel George Washington Rains was selected to oversee its operation. Within weeks, the mill was producing nearly 10,000 pounds of high-quality gunpowder in each 15-hour shift. By the end of the war, the Augusta plant was responsible for having shipped more than 1.5 million pounds of powder to the capital city of Richmond alone.

Rains had attended West Point, majoring in scientific studies and graduating in 1842 at the top of his class. He went on to serve as a professor of chemistry, geology and mineralogy at his alma mater. Despite Rains' limited knowledge of gunpowder composition, the Confederate chief of ordnance, Josiah Gorgas, gave him complete control of locating, mining and refining all necessary ingredients for the powder's production.

Prior to the outbreak of war, gunpowder had not been warehoused within any of the Southern States, and only a small fraction of the Confederacy's need had been met by confiscating the powder from the Norfolk Navy Yard and other such installations.

Initial attempts to supplement what little gunpowder the South had on hand began in the early winter of 1861. A laboratory and two mills were constructed in New Orleans, with the intent to manufacture fuzes, primers and gunpowder. By the first week of December, the mills were producing just over 2 tons per day; yet they had outstanding orders for an additional 200 tons. Then, on December 28, an explosion within the complex brought the entire operation to a standstill. Orders



An exterior view, by Pete Gaut, of the gunpowder processing complex constructed by Confederate Colonel George Washington Rains and his Nitre Bureau near Augusta, Ga.—a masterpiece of industrial ingenuity.

for gunpowder, at 83 cents per pound, continued to pour in. By January 13, 1862, the New Orleans stockpile had dwindled to 116,000 pounds, pushing prices to record highs of \$1.14 per pound.

Meanwhile, Confederate laborers worked low-grade nitre (or niter) deposits within the lengthy limestone caverns of Kentucky. However, the vast majority of these underground passageways were captured by invading Union forces in early 1862. By the time Rains found it necessary to expand Nitre Bureau operations to new locations, total output of nitre mining in the South was only about 500 pounds per day.

The gunpowder of the day, as Rains came to realize, was typically composed of 75 percent potassium nitrate and smaller amounts of charcoal and sulphur. It seemed doubtful that he would be able to secure enough of these scarce ingredients, however, to fill the growing number of orders. In fact, he was convinced that the best he might hope for would be an insufficient supply of second-rate gunpowder.

Undaunted, Rains dispatched teams to explore the limestone caverns of Arkansas, Alabama, Tennessee and Georgia. They

were amazed to find earth that contained high concentrates of valuable nitrate of lime, and Rains immediately ordered workmen to begin excavation procedures.

Incorporating a rather crude chemical process—the saturation of freshly mined earth with lye made from wood ash—Rains was able to transform the raw commodity into nitre. An abandoned Nashville mill was soon producing an excellent grade of gunpowder, with a nearby stamping mill furnishing its refined ingredients. By July 10, 1861, after just four months of operation, the Nashville plant was manufactur-

ing nearly 3,000 pounds per day.

While miners continued to search for nitre deposits, Rains returned to Richmond, where he established a smuggling operation for gunpowder from Europe. Profits for those involved were immense, with captains of blockade-running vessels earning up to \$5,000 per crossing; chief officers, \$1,250; chief engineers, \$2,500; pilots, \$3,500; second and third mates, \$750; and the crew and firemen netting a respectable \$250 each. The total number of vessels arriving safely in port during the four-year conflict is estimated to have been 1,650, with approximately 2,700,000 pounds of gunpowder hidden within their hulls.

While gunpowder continued to flow across the Atlantic, Rains was still hard at work organizing domestic production. Perhaps the most intriguing segment of his plan was the division of the South into districts, each of which was assigned a crew to dig the earth from beneath privies and latrines. There they found nitre, naturally produced by mingling the nitrogenous matter in human waste with quicklime deposits.

What They Fought For 1861-1865

by James M. McPherson

From the Pulitzer Prize-winning author of *Battle Cry of Freedom* comes this lively investigation into what motivated the men in blue and gray. James M. McPherson offers excerpts from the letters or diaries of nearly one thousand Union and Confederate soldiers and officers. He reads that—contrary to the prevailing belief that Civil War soldiers had little or no idea of what they were fighting for—most of them felt a keen sense of patriotic and ideologic commitment.



Illustration by Edwin Forbes

... makes more under-
... the willingness of
... fight and die amidst
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Despite such diverse tactics to produce an ample supply of gunpowder, Rains knew that much more needed to be accomplished. Hence he decided to begin construction of a full-scale processing plant. As a suitable site he chose a two-mile stretch along a manmade canal near Augusta, Ga. The complex itself would be built from excess materials shipped in from all across the Confederacy.

From the Tredegar Iron Works in Richmond, Rains secured a dozen circular iron plates, along with 24 rollers weighing 5 tons each. An additional four rollers came from Chattanooga, Tenn., and an area just south of Macon, Ga. A gear wheel 16 feet in diameter was cast in Atlanta, and a 12-inch-thick, 300-foot-long iron shaft was imported from England. *

As construction began, an aging 130-hp steam engine was located, decaying within the confines of an abandoned cotton mill, and it was quickly disassembled and transported by rail. Made of five huge boilers and a 14-ton flywheel, the entire machine had been designed and manufactured in Pennsylvania prior to the war.

Rains ordered a dozen evaporating pans from an iron works plant along the Cumberland River in Tennessee: copper boilers were converted from turpentine and whiskey stills confiscated in the backwoods of Kentucky; and giant retorts and iron cylinders came out of a nearby Augusta manufacturing concern. Coal and iron ore were dispatched from North Carolina; raw copper was sent from Ducktown, Tenn.; and zinc, which would be used in the warehouse roofs, arrived from distant Mobile. Finally, in late April 1862, Rains was prepared to begin operation.

Rains understood that the purification of sulphur demanded the complete removal of all traces of acid, and that his incoming supply was far from perfect. Most of it had been purchased from Louisiana sugar growers, who had imported the sulphur prior to the war in order to refine their harvest. The powder, after treatment, would have to hold up to the strict test of standing on glass without leaving residual stains.

The method devised by Rains to refine and crystallize sulphur was a rather complicated procedure. Ingeniously, he arranged a series of evaporation pans within one building. Water from the nearby canal was diverted to flow beneath some of these pans, so that they might be quickly cooled, while others were heated by a series of furnaces. This setup ensured that the entire area would remain free from contaminating smoke and ash. When Rains discovered that his crew could not keep up with the demand, he devised an automated system by which the pans could be filled by pouring boiling water into individual draining and crystallizing vats. This system allowed three complete cycles

per day, with only two or three workmen on duty at any one time.

The distilling process continued with the smelting of the sulphur, which was then poured into wooden boxes with tapering, 5-foot-high sides and 10-inch-square bottoms. As the heated material cooled, impurities settled, leaving the upper portion relatively pure. Then the sulphur was transferred into large vats, where it was vaporized and condensed inside of water-cooled coils. Next, it was recollected and pulverized to the density of powdered flour by 5-foot-thick iron rollers. Finally, the dusty substance was sifted through large sheets of silk.

Later, when the Confederacy's silk supply was all but exhausted, Rains was forced to devise another sifting method. By attaching hollow axles to revolving barrels, he was able to blow the finest sulphur dust into an adjoining room by means of pulsating blasts of hot air.

Charcoal, another essential ingredient in gunpowder composition, was also quite scarce during the early stages of the war. In the past, willow trees—believed to be the best source available—had been used in its manufacture. The supply had quickly become exhausted, and Rains was forced to test other types of wood. He soon discovered that cottonwood was a suitable substitute.

Cottonwood logs were first split into 2-inch-square boards and packed into 6-foot-long iron cylinders. Retorts were then attached over the skins of the cylinders and sealed with red Georgia clay. Next, with the bottoms perforated to allow gases to escape, the wood was set on fire and allowed to burn for approximately two hours. The cylinders were then cooled in the canal, after which the charred wood was extracted and placed into barrels, where it would be pulverized by the continual rolling motion of bronze balls. After undergoing its own sifting process, the charcoal was transported to the weighing room, where it was measured and carefully mixed with the other essential ingredients.

Rains combined 9 pounds of charcoal with 45 pounds of nitre and 6 pounds of sulphur. These batches were then individually saturated with water and steamed. Rains was the first to reduce gunpowder to slush, allowing the nitre to partially crystallize within the charcoal carbon. Such ingenuity reduced the final rolling process from four hours to less than one.

Eventually, after each batch was dried into solid cakes, samples were taken and placed under microscopes for further scrutiny. After inspecting the unique mixture for several days, Rains decided that the carbon particles were still far too pitted with minute holes. Yet, since nitre was the active ingredient in gunpowder, he opted to use it to fill these tiny cavities—another entirely novel concept in the art of gunpowder production.

Mississippi Civil War Re-enactment Calendar

The guns still roar and the troops still charge at authentic battle re-enactments staged throughout Mississippi. The following is a partial listing of annual re-enactment activities.

April 24, 1994

Confederate Day Celebration. Beauvoir in Biloxi. Always the 4th Sunday in April. For more information, call (601)388-1313.

May 14-15, 1994

Battle of Champion Hill. Battle re-enactment featuring cannons, cavalry, infantry charge, explosives. Admission. Off 1-20. Exit 19 near Edwards. For more information, call (601)373-7144.

May 28-29, 1994

"Siege and Fall of Vicksburg." Events scheduled throughout Vicksburg. A two day re-enactment of the siege, battle and fall of Vicksburg. For more information, call 1-800-221-3530.

July 2-3, 1994

"Assault on Vicksburg." A living history demonstrates how life was for the citizens of Vicksburg during the siege, re-enactors and firing of cannons along the Mississippi river. For more information, contact 1-800-221-3530.

October 15-16, 1994

Fall Muster. Beauvoir, Biloxi. Re-creation of Confederate encampment, skirmishes with re-enactors. For more information, call (601)388-1313.

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Rains proceeded to construct a dozen more rolling mills within the Augusta complex, each of which spanned nearly 300 feet along the banks of the canal.

During the first few months of operations, however, a catastrophic explosion nearly spelled disaster for the entire complex. The force of the devastating charge sent up a huge 500-foot geyser of smoke, gravel and flames, destroying 3 tons of gunpowder and killing seven men in the process. Later, it was determined that a careless worker had disobeyed strict regulations concerning cigarette smoking within a highly restricted area.

Wooden sidewalls measuring 10 feet thick were constructed between each structure, and all front entryways were outfitted with 2-inch-thick glass shields. Workmen operated long levers by way of a friction gear built beneath each building's floors, so that the dangerous rollers could be controlled from a safe distance. As a further precaution, 30-gallon sprinkler tanks were installed above each roller, rigged so that they would spill their contents in the event of a fire.

The gunpowder warehouses were next on Rains' agenda. The powder magazines themselves were stored beneath the ground and covered at the surface by thick brick traverses. Each mound was individually shielded from outside elements by a lightweight zinc roof. Furthermore, they were designed in such a fashion as to ensure that any individual explosion would not set off a chain reaction. All storehouses as well as the mines and mills were guarded around the clock by a contingency of highly trained soldiers, whose numbers reached well into the hundreds.

The intensive search for nitre paid off rather quickly for Rains and his crew, for a large deposit was discovered in Texas. By the end of October 1862, it was producing more than 2,000 pounds of raw material per day, with stockpiles reaching an astounding 2,000 tons.

It has been calculated that Rains' Augusta operation produced a total of more than 2.75 million pounds of high-quality gunpowder, enabling him to fill every demand sent his way. By the end of 1862, the cost of smuggled gunpowder had risen to nearly \$3 per pound. With an output of more than 1 million pounds during that same year, Rains managed to save the Confederacy in excess of \$2 million, and the huge complex had cost the South less than 20 percent of that amount.

Despite the fact that the Confederacy steadily lost much of its gunpowder supply to invading Union forces, and despite being cut off from the mining operation in Texas, the Nitre Bureau was able to maintain an average output of 2,000 pounds of gunpowder per day over a 36-month period. Certainly, Colonel George Washington Rains deserves much of the credit for that amazing accomplishment. =

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